CLAIMS

What is claimed is:

1. A tracking error signal generating apparatus comprising:

a main beam push pull (MPP) signal generating unit which generates an MPP signal according to electrical signals output by main photodetecting units based on a calculated deviation of beam powers detected by the main photodetecting units arranged on right and left sides of a specific track, respectively;

a side beam push pull (SPP) signal generating unit which generates an SPP signal according to electrical signals output by photodetecting units based on a calculated deviation of beam powers detected by the photodetecting units, the photdetecting units being one of pairs of the main photodetecting units diagonally arranged with respect to the track and side photodetecting units disposed on opposing sides of the track and outside of the main photdetecting units;

a filter which removes AC components from the SPP signal; and

a subtractor which generates a tracking error signal by calculating a difference between the MPP signal and the filtered SPP signal.

2. The apparatus of claim 1, wherein the MPP signal generating unit generates the MPP signal by performing an operation on electrical signals a, b, c, and d which satisfies an equation MPP = (a+d) - (b+c) and the SPP signal generating unit generates the SPP signal by performing an operation on the electrical signals a, b, c, and d which satisfies an equation SPP = (a+c) - (b+d), wherein the main photodetecting units comprise main photodetecting units PD_A, PD_B, PD_c, and PD_D which respectively output the electrical signals a, b, c, and d, wherein the main photodetecting units PD_A, PD_B, PD_C, and PD_D are positioned at four quadrants in a clockwise direction, and wherein the main photodetecting units PD_A and PD_D are symmetrically arranged with the main photodetecting units PD_B and PD_C with respect to the track.

3. The apparatus of claim 1, wherein the MPP signal generating unit generates an MPP signal by performing an operation on electrical signals a, b, c, and d which satisfies an equation MPP= (a+d) - (b+c) and the SPP signal generating unit generates an SPP signal by performing an operation on electrical signals e and f which satisfies an equation SPP= (e-f), wherein the main photodetecting units comprise main photodetecting units PD_A, PD_B, PD_C, and PD_D which respectively output the electrical signals a, b, c, and d, wherein the main phtodetecting units PD_A, PD_B, PD_C, and PD_D are positioned at four quadrants in a clockwise direction, wherein the main photodetecting units PD_A and PD_D are symmetrically arranged with the main photodetecting units PD_B and PD_C with respect to the track, wherein the side photodetectors comprise side photodetecting units PD_E and PD_F which respectively output electrical signals e and f, and wherein the side photodetecting units PD_E and PD_F are symmetrically arranged at opposing sides of the track and outside of the main photodetecting units PD_A, PD_B, PD_C, and PD_D.

4. A method of generating a tracking error signal comprising:

calculating a difference between an MPP signal and an SPP signal whose AC components are removed,

wherein the MPP signal is obtained by calculating a deviation of beam powers detected by main photodetecting units which are arranged in right and left directions with respect to a track and the SPP signal is obtained by calculating a deviation of beam powers detected by photodetecting units which are one of pairs of the main photodetectors diagonally arranged with respect to the track and side photodecting units disposed on opposing sides of the track and outside of the main photodetecting units.

5. The method of claim 4, wherein the MPP signal is obtained by performing an operation on electrical signals a, b, c, and d which satisfies an equation MPP = (a+d) - (b+c) and the SPP signal generating unit generates the SPP signal by performing an operation on the electrical signals a, b, c, and d which satisfies an equation SPP = (a+c) - (b+d), wherein the main photodetecting units comprise main photodetecting units PD_A, PD_B, PD_c, and PD_D which respectively output the electrical signals a, b, c, and d, wherein the main photodetecting units PD_A, PD_B, PD_C, and PD_D are positioned at four quadrants in a clockwise direction, and wherein the main photodetecting units PD_A and PD_D are symmetrically arranged with the main photodetecting units PD_B and PD_C with respect to the track.

6. The method of claim 4, wherein the MPP signal is obtained by performing an operation on electrical signals a, b, c, and d which satisfies an equation MPP= (a+d) - (b+c) and the SPP signal generating unit generates an SPP signal by performing an operation on electrical signals e and f which satisfies an equation SPP= (e-f), wherein the main photodetecting units comprise main photodetecting units PD_A, PD_B, PD_C, and PD_D which respectively output the electrical signals a, b, c, and d, wherein the main phtodetecting units PD_A, PD_B, PD_C, and PD_D are positioned at four quadrants in a clockwise direction, wherein the main photodetecting units PD_A and PD_D are symmetrically arranged with the main photodetecting units PD_B and PD_C with respect to the track, wherein the side photodetectors comprise side photodetecting units PD_E and PD_F which respectively output electrical signals e and f, and wherein the side photodetecting units PD_E and PD_F are symmetrically arranged at opposing sides of the track and outside of the main photodetecting units PD_A, PD_B, PD_C, and PD_D.

7. An optical recording/reproducing system, comprising:

a pickup which emits a laser beam toward an optical medium and detects a reflected laser beam reflected from a disc;

a tracking error signal generating unit that generates a tracking error signal by calculating a difference between an MPP signal obtained by calculating a deviation of beam powers detected by main photodetecting units which are arranged in right and left directions with respect to a track and an SPP signal obtained by calculating a deviation of beam powers detected by photodetecting units which are one of main photodetecting units diagonally arranged with respect to the track and signals output by side photodetecting units disposed on opposing sides of the main photodetectors;

a servo controller which generates a tracking driving signal which is used to move an optical system of the pickup in a radial direction so as to direct the laser beam at a center of the track, using the tracking error signal; and

a tracking servo driving unit which drives a tracking actuator included in the pickup in response to the tracking driving signal.

8. The system of claim 7, wherein the MPP signal is obtained by performing an operation on electrical signals a, b, c, and d which satisfies an equation MPP = (a+d) - (b+c) and the SPP signal generating unit generates the SPP signal by performing an operation on the electrical signals a, b, c, and d which satisfies an equation SPP = (a+c) - (b+d), wherein the

main photodetecting units comprise main photodetecting units PD_A, PD_B, PD_c, and PD_D which respectively output the electrical signals a, b, c, and d, wherein the main photodetecting units PD_A, PD_B, PD_C, and PD_D are positioned at four quadrants in a clockwise direction, and wherein the main photodetecting units PD_A and PD_D are symmetrically arranged with the main photodetecting units PD_B and PD_C with respect to the track.

9. The system of claim 7, wherein the MPP signal is obtained by performing an operation on electrical signals a, b, c, and d which satisfies an equation MPP= (a+d) - (b+c) and the SPP signal generating unit generates an SPP signal by performing an operation on electrical signals e and f which satisfies an equation SPP= (e-f), wherein the main photodetecting units comprise main photodetecting units PD_A, PD_B, PD_C, and PD_D which respectively output the electrical signals a, b, c, and d, wherein the main phtodetecting units PD_A, PD_B, PD_C, and PD_D are positioned at four quadrants in a clockwise direction, wherein the main photodetecting units PD_A and PD_D are symmetrically arranged with the main photodetecting units PD_B and PD_C with respect to the track, wherein the side photodetectors comprise side photodetecting units PD_E and PD_F which respectively output electrical signals e and f, and wherein the side photodetecting units PD_E and PD_F are symmetrically arranged at opposing sides of the track and outside of the main photodetecting units PD_A, PD_B, PD_C, and PD_D.

10. A computer readable medium encoded with processing instructions for implementing a method of generating a tracking error signal, the method comprising:

calculating a difference between an MPP signal and an SPP signal whose AC components are removed,

wherein the MPP signal is obtained by calculating a deviation of beam powers detected by main photodetecting units which are arranged in right and left directions with respect to a track and the SPP signal is obtained by calculating a deviation of beam powers detected by photodetecting units which are one of pairs of the main photodetectors diagonally arranged with respect to the track and side photodecting units disposed on opposing sides of the track and outside of the main photodetecting units.

11. A tracking error signal generator comprising:

a main push pull (MPP) signal generator which generates an MPP signal based on a difference between a first sum signal representing the sum of signals output from main photodetecting portions disposed on a side of a track and a second sum signal representing the sum of signals output by the main photodetecting portions disposed on an opposing side of the track;

a side push pull (SPP) signal generator which generates an SPP signal based on a difference between one of a third sum signal representing the sum of signals output from the main photodetecting portions which are diagonally disposed with respect to the track in a first direction and a fourth sum signal representing the sum of signals output by the main photodetecting portions diagonally disposed with respect to the track in a second direction normal to the first and a fifth signal output by a first side photodetector and a sixth signal output by a second side photodetector;

a filter which removes one or more AC components from the SPP signal; and

a subtractor which generates a tracking error signal based on a difference between the MPP signal and a filtered SPP signal.

12. The tracking error signal generator of claim 11, wherein the main photodetecting portions are positioned at four quadrants of a photodetector in a clockwise direction and the main photodetecting portions on the first side of the track are symmetrically arranged with the main photodetecting portions on the opposing side of the track.

13. The tracking error signal generator of claim 11, wherein the side photodectors are disposed at opposing sides of the track and outside of the main photodetectors

14. A method of generating a tracking error signal, comprising:

generating a main push pull (MPP) signal based on a difference between a first sum signal representing the sum of signals output from main photodetecting portions disposed on a side of a track and a second sum signal representing the sum of signals output by the main photodetecting portions disposed on an opposing side of the track;

generating a side push pull (SPP) signal based on a difference between one of a third sum signal representing the sum of signals output from the main photodetecting portions which are diagonally disposed with respect to the track in a first direction and a fourth sum signal representing the sum of signals output by the main photodetecting portions diagonally disposed with respect to the track in a second direction normal to the first and a firth sum signal output by a first side photodetector and a sixth sum signal output by a second side photodetector;

removing one or more AC components from the SPP signal; and

generating a tracking error signal based on a difference between the MPP signal and a filtered SPP signal.

15. The method of claim 14, wherein the main photodetecting portions are positioned at four quadrants of a photodetector in a clockwise direction and the main photodetecting portions on the first side of the track are symmetrically arranged with the main photodetecting portions on the opposing side of the track.

16. The method of claim 14, wherein the side photodectors are disposed at opposing sides of the track and outside of the main photodetectors.

17. A computer readable medium encoded with processing instructions for implementing a method of generating a tracking error signal, the method comprising:

generating a main push pull (MPP) signal based on a difference between a first sum signal representing the sum of signals output from main photodetecting portions disposed on a side of a track and a second sum signal representing the sum of signals output by the main photodetecting portions disposed on an opposing side of the track;

generating a side push pull (SPP) based on a difference between one of a third sum signal representing the sum of signals output from the main photodetecting portions which are diagonally disposed with respect to the track in a first direction and a fourth sum signal representing the sum of signals output by the main photodetecting portions diagonally disposed with respect to the track in a second direction normal to the first and a firth sum signal output by a first side photodetector and a sixth sum signal output by a second side photodetector;

removing one or more AC components from the SPP signal; and

generating a tracking error signal based on a difference between the MPP signal and a filtered SPP signal.

18. The computer readable medium of claim 17, wherein the main photodetecting portions are positioned at four quadrants of a photodetector in a clockwise direction and the main photodetecting portions on the first side of the track are symmetrically arranged with the main photodetecting portions on the opposing side of the track.

19. The computer readable medium of claim 17, wherein the side photodectors are disposed at opposing sides of the track and outside of the main photodetectors.

20. An optical recording/reproducing system, comprising:

a pickup having a light beam generator which generates a light beam, an optical system which focuses the light beam onto an optical medium, a focus/tracking actuator which moves the optical system in a radial direction with respect to the optical medium in response to a tracking driving signal so as to direct the light beam at a specific track on the optical medium, and a photodetector section including main photodetecting portions which receive the light beam after the light beam is reflected from the optical medium and output respective signals in response thereto;

a tracking error signal generator which generates a tracking error signal representing a difference between a main push pull (MPP) signal and a side push pull (SPP) generator;

a servo controller which generates the tracking driving signal based on the tracking error signal,

wherein the MPP signal is generated based on a difference between a first sum signal representing the sum of signals output from the main photodetecting portions disposed on a side of a track and a second sum signal representing the sum of signals output by the main photodetecting portions disposed on an opposing side of the track, and

wherein the SPP signal is generated based on a difference between one of a third sum signal representing the sum of signals output from the main photodetecting portions which are diagonally disposed with respect to the track in a first direction and a foirth sum signal representing the sum of signals output by the main photodetecting portions diagonally disposed with respect to the track in a second direction normal to the first and a fifth signal output by a first side photodetector and a sixth signal output by a second side photodetector.

21. The optical recording/reproducing system of claim 20, wherein the main photodetecting portions are positioned at four quadrants of a photodetector in a clockwise direction and the main photodetecting portions on the first side of the track are symmetrically arranged with the main photodetecting portions on the opposing side of the track.

22. The optical recording/reproducing system of claim 20, wherein the side photodectors are disposed at opposing sides of the track and outside of the main photodetectors.

23. A filter in a tracking error signal generating circuit which generates a tracking error signal using a differential push pull method, comprising:

an AC component remover which removes one or more AC components from a side beam push pull (SPP) signal,

wherein the SPP signal is obtained by using electrical signals output by photodetecting units based on a calculated deviation of beam powers detected by the photodetecting units, the photodetecting units being one of pairs of the main photodetecting units diagonally arranged with respect to the track and side photodetecting units disposed on opposing sides of the track and outside of the main photdetecting units, and

wherein the tracking error signal can be stably generated regardless of a disc track pitch.